Practical 4

Aim: A] Implementation of Python Libraries such as Math, Numpy and Scipy.
B] Implementation of Python Libraries for ML application such as Pandas and Matplotlib.

Python
Python is a very popular general-purpose interpreted, interactive, object-oriented, and high-level programming language. Python is dynamically-typed and garbage-collected programming language.
Python programming language (latest Python 3) is being used in web development, Machine Learning applications, along with all cutting edge technology in Software Industry. Python Programming Language is very well suited for Beginners, also for experienced programmers with other programming languages like C++ and Java.

Installation of python in Ubuntu

1. Open up your terminal by pressing Ctrl + Alt + T.
2. Update your local system's repository list by entering the following command:
sudo apt update
3. Download the latest version of Python: sudo apt install python3
4. APT will automatically find the package and install it on your computer.

Libraries in Python

- TensorFlow
- Scikit-Learn
- Numpy
- Keras
- PyTorch
- LightGBM
- Eli5
- SciPy
- Theano
- Pandas

A] Implementation of Python Libraries such as Math,Numpy and Scipy.

1. Math

This is the most basic math module that is available in Python. It covers basic mathematical operations like sum, exponential, modulus, etc.

This library is not useful when dealing with complex mathematical operations like multiplication of matrices.

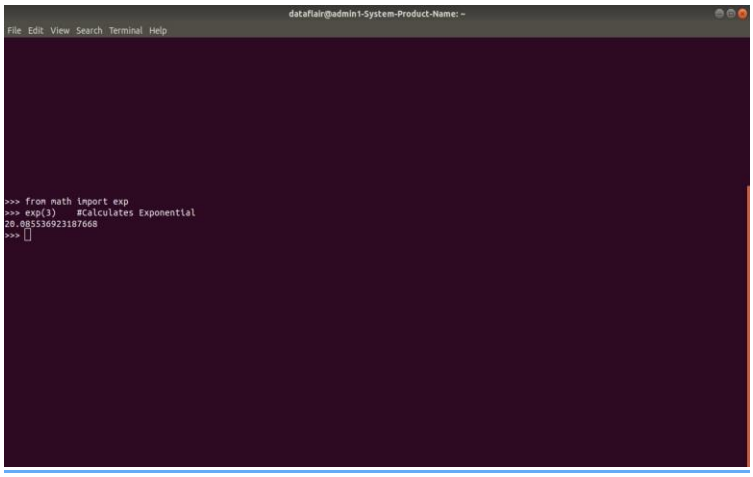
The calculations performed with the functions of the python math library are also much slower.

However, this library is adequate when you have to carry out basic mathematical operations.

For example: You can carry out the exponential of 3 using the exp() function of python math library as follows:

```
>>> from math import exp
>>> exp(3) #Calculates Exponential
```

Output



2. Numpy

NumPy is the most popular library in Python. This library is used for processing large multi-dimensional array and matrix formation by using a large collection of high-level mathematical functions and formulas. It is mainly used for the computation of fundamental science in machine learning. It is widely used for linear algebra, Fourier transformation, and random number capabilities. There are other High-end libraries such as TensorFlow, which user NumPy as internal functioning for manipulation of tensors.
Program:

```
import numpy as nup

# Then, create two arrays of rank 2

K = nup.array([[2, 4], [6, 8]])

R = nup.array([[1, 3], [5, 7]])

# Then, create two arrays of rank 1
```

```
P = nup.array([10, 12])
S = nup.array([9, 11])
# Then, we will print the Inner product of vectors
print ("Inner product of vectors: ", nup.dot(P, S), "\n")
# Then, we will print the Matrix and Vector product
print ("Matrix and Vector product: ", nup.dot(K, P), "\n")
# Now, we will print the Matrix and matrix product
print ("Matrix and matrix product: ", nup.dot(K, R))
```

Output:

```
Inner product of vectors: 222

Matrix and Vector product: [ 68 156]

Matrix and matrix product: [[22 34]
                           [46 74]]
```

3. SciPy

SciPy is a popular library among Machine Learning developers as it contains numerous modules for performing optimization, linear algebra, integration, and statistics. SciPy library is different from SciPy stack, as SciPy library is one of the core packages which made up the SciPy stack. SciPy library is used for image manipulation tasks.
Program:

```
from scipy import signal as sg
import numpy as nup
K = nup.arange(45).reshape(9, 5)
domain_1 = nup.identity(3)
print (K, end = 'KK')
print (sg.order_filter (K, domain_1, 1))
```

Output

```
r (K, domain_1, 1))
Output:
[[ 0  1  2  3  4]
 [ 5  6  7  8  9]
 [10 11 12 13 14]
 [15 16 17 18 19]
 [20 21 22 23 24]
 [25 26 27 28 29]
 [30 31 32 33 34]
 [35 36 37 38 39]
 [40 41 42 43 44]] KK [[ 0.  1.  2.  3.  0.]
 [ 5.  6.  7.  8.  3.]
 [10. 11. 12. 13.  8.]
 [15. 16. 17. 18. 13.]
 [20. 21. 22. 23. 18.]
 [25. 26. 27. 28. 23.]
 [30. 31. 32. 33. 28.]
 [35. 36. 37. 38. 33.]
 [ 0. 35. 36. 37. 38.]]
```

B] Implementation of Python Libraries for ML application such as Pandas and Matplotlib.

1. Pandas

Pandas is a Python library that is mainly used for data analysis. The users have to prepare the dataset before using it for training the machine learning. Pandas make it easy for the developers as it is developed specifically for data extraction. It has a wide variety of tools for analysing data in detail, providing high-level data structures.

Program:

```
import pandas as pad

data_1 = {"Countries": ["Bhutan", "Cape Verde", "Chad", "Estonia", "Guinea", "Kenya", "
Libya", "Mexico"],"capital": ["Thimphu", "Praia", "N'Djamena", "Tallinn", "Conakry", "Nai
robi", "Tripoli", "Mexico City"],"Currency": ["Ngultrum", "Cape Verdean escudo", "CFA Fr
anc", "Estonia Kroon; Euro", "Guinean franc", "Kenya shilling", "Libyan dinar", "Mexican
peso"],  "population": [20.4, 143.5, 12.52, 135.7, 52.98, 76.21, 34.28, 54.32] }
```

```
data_1_table = pad.DataFrame(data_1)

print(data_1_table)
```

Output:

```
    Countries      capital            Currency  population
0      Bhutan      Thimphu            Ngultrum       20.40
1  Cape Verde        Praia  Cape Verdean escudo      143.50
2        Chad    N'Djamena           CFA Franc       12.52
3     Estonia      Tallinn  Estonia Kroon; Euro      135.70
4      Guinea      Conakry        Guinean franc       52.98
5       Kenya      Nairobi       Kenya shilling       76.21
6       Libya      Tripoli         Libyan dinar       34.28
7      Mexico  Mexico City        Mexican peso       54.32
```

2. Matplotlob

Matplotlib is a Python library that is used for data visualization. It is used by developers when they want to visualize the data and its patterns. It is a 2-D plotting library that is used to create 2-D graphs and plots.

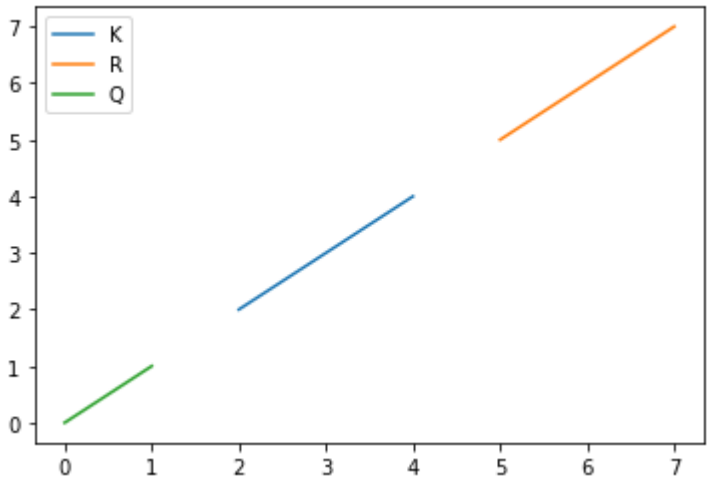
It has a module pyplot which is used for plotting graphs, and it provides different features for control line styles, font properties, formatting axes and many more. Matplotlib provides different types of graphs and plots such as histograms, error charts, bar charts and many more.

Program:

```
import matplotlib.pyplot as plot

import numpy as nup

# Prepare the data

K = nup.linspace(2, 4, 8)

R = nup.linspace(5, 7, 9)

Q = nup.linspace(0, 1, 3)

# Plot the data

plot.plot(K, K, label = 'K')

plot.plot(R, R, label = 'R')

plot.plot(Q, Q, label = 'Q')

# Add a legend
```

```
plot.legend()
# Show the plot
plot.show()
```

Output:



Result: Implementation of Python libraries such as Math, Numpy and Scipy was done successfully.
Implementation of Python libraries libraries for ML application such as Pandas and Matplotlib.